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Comprehensive evaluation method of live streaming business model in online marketing environment

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Abstract: In order to effectively analyse the business model of live streaming, this article studies a comprehensive evaluation method for live streaming business models in an online marketing environment. Firstly, the analytic hierarchy process is used to determine the 20 evaluation indicators of the indicator layer. Then, calculate the indicator weights based on the entropy method. Finally, based on comprehensive evaluation indicators, conduct a comprehensive evaluation of the live streaming business model. Through experiments, it can be seen that the evaluation method proposed in this article can accurately analyse the importance of evaluation indicators, and the evaluation results are consistent with the actual state of the live streaming sales business model. Multiple secondary indicators designed can better measure economic effectiveness, marketing effectiveness, market competition, and consumer influence, which can reflect the good practical application performance of the proposed method in this article.

Keywords: network marketing; live streaming with goods; business model; comprehensive assessment; evaluation metrics.

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1 Introduction

At present, the online media industry is rapidly emerging with the development of society. Marketing communication is the organic combination of market and communication, business communication refers to a company in order to make consumers know and buy the goods it sells, so as to have a certain understanding of the goods to take an action, 'marketing' is the voice of the company and the brand. With the continuous change of media, the scale of online marketing is also expanding, so the most popular shopping method was born: live shopping (Chen, 2020). In the past live broadcast environment, the encoded signal was generally transmitted to the live broadcast server through the internet or a private network, where the signal was decoded and restored to the original signal and forwarded to the audience for playback (Cheng and Zhang, 2023). Generally, the content of the party, competition, etc. is broadcast live. At this stage, due to the rise of self-media, personal platform users can also live broadcast on various network platforms, and live shopping is developed in this time period. The marketing model of live shopping is to fully combine the network and marketing, triggered by the real-time interaction of live broadcast on the network platform, which not only brings a full range of initiative to business exchanges, but also provides fuller advantages and initiative for live broadcast of goods (Fan and Wang, 2022). Product communication on site is both an opportunity and a challenge for companies. Therefore, many companies have discovered the business opportunities brought by the celebrity effect in live shopping, and some users can pay for the products recommended by their favourite anchors, so live streaming has gradually become the hottest and most topical marketing method in the live broadcast industry (Zhang et al., 2022). But with the prosperity of the live broadcast economy, some problems have gradually been exposed. In order to bring consumers a better consumer experience, avoiding quality and after-sales problems caused by online live streaming is the key point to consider in today's live streaming model. Therefore, it is necessary to conduct a comprehensive evaluation of the network marketing model.

Some relevant experts in the field of industrial and commercial economics have put forward some views. Some researchers have constructed an index system to evaluate the overall level of e-commerce marketing according to the marketing content, determined the indicators of the influencing factors in the evaluation system through the analytic hierarchy method and calculated the weight of each index, clustered the indicators through the Apriori algorithm in correlation analysis, and finally obtained the marketing plan with the best evaluation, and completed the evaluation of the network marketing

model (Mei and Liu, 2019). There are also experts in the field of trade economics to evaluate the marketing performance of a product in network marketing based on data envelopment analysis. Collect and count the marketing data of the product in social networks, take the current domestic hot e-commerce platforms as the benchmark, count the discussion of the product in the process of network marketing, mainly based on the frequency of content release, reply, forwarding and comment volume as indicators, use the data envelopment analysis method to calculate the marketing effect of the product, build a data envelopment model, setup a performance evaluation system, and realise the evaluation of the marketing performance of the product in network marketing (Ren et al., 2021). In addition, some scholars who study computer software and enterprise economy have built a cross-border e-commerce service quality evaluation system with the digital economy as the research background. Taking cross-border e-commerce platforms as the object, 22 evaluation indicators are analysed and established from multiple aspects, and the online marketing mode of each platform is specifically analysed, and each platform has good advantages in different aspects, and the evaluation range is wider, which can realise the evaluation of the service quality of the e-commerce platform (Zhuang and Yang, 2022). In addition, experts in macroeconomic management propose a method for evaluating e-commerce marketing service models based on fuzzy synthesis theory and random forest algorithm. Taking the service satisfaction in online marketing of e-commerce platform as the main evaluation index, the service satisfaction evaluation model is established by the fuzzy comprehensive evaluation algorithm, and the work efficiency of e-commerce and logistics is evaluated, and then the model is optimised by combining the random forest algorithm to obtain the final effective evaluation of the e-commerce marketing service model (Zhao, 2021).

Although the above existing methods can effectively evaluate the online marketing model and service quality in the e-commerce platform, there is little research on the current live streaming business model, and it is impossible to conduct detailed analysis and effective evaluation of the live streaming business model, which is not conducive to the development of the live streaming network business model. Therefore, based on the above research, this paper conducts research on the business model of live streaming in the online marketing environment, and comprehensively evaluates this model. The core route of this article is as follows:

1 Based on the analytic hierarchy process, a comprehensive evaluation system for the live streaming sales business model was established, with economic effectiveness, marketing effectiveness, market competition, and consumer impact as the criteria layer indicators. Detailed screening was conducted based on the criteria layer indicators, and 20 evaluation indicators were determined for the indicator layer.

2 Standardise the evaluation indicators, calculate the information entropy values of each indicator based on the entropy method, obtain redundant values, calculate the weights of each evaluation indicator, and determine the indicator weights.

3 Determine the correlation degree of each evaluation indicator, use the comprehensive evaluation method to comprehensively evaluate 20 indicators, establish a comprehensive evaluation index, score the live streaming sales business model based on the content of the evaluation indicators, match the corresponding levels based on the scores, and obtain the comprehensive evaluation results of the live streaming sales business model in the online marketing environment.

2 Analysis of live streaming business model in online marketing environment

2.1 The relationship between online marketing and live streaming

The live streaming business model refers to the business model of recommending and introducing products through live broadcast content on the online live broadcast platform, guiding and prompting viewers to purchase goods online, and obtaining profit methods such as product sales commissions, advertising revenue, etc. In the process of live streaming goods, the live broadcaster provides the audience with the practical value and purchase experience of the goods by displaying the goods, sharing the use experience, answering doubts, etc. and realises the sales and marketing of the goods. At present, the live streaming business model has been widely used in the Chinese market, and has become a hot spot in the field of new retail and social e-commerce (Li and Wang, 2022). E-commerce live streaming is a new way of life that has achieved rapid sales growth based on close conversations with products, face-to-face videos with customers and simulation experiments (Sun, 2023). As a new type of e-commerce model, live streaming has been recognised by more and more enterprises and consumers in terms of marketing methods and communication effects. At this stage, the main characteristics of the live streaming business model are:

First, as the introducer of products, live broadcasters can fully use social media to improve the effect of product marketing.

Second, compared with the traditional e-commerce sales model, live streaming is more interesting and interactive for consumers, increasing the desire to purchase goods (Abudureherman, 2022).

Third, livestreamers usually have a certain fan base and influence, which helps increase the sales and reputation of their products.

It is precisely for this reason that live streaming has become a hot online marketing model at this stage, making new e-commerce models such as celebrity live streaming goods, local leaders, well-known personalities live streaming goods, and endorsement and sales also appearing.

At present, for network marketing companies of different sizes, live streaming mainly covers the following three business models:

1 Self-operated model: The brand itself recruits anchors and carries out live streaming business. This model is usually suitable for large brands and enterprises with certain resources. The self-operated model is relatively stable, and the brand image can be promoted and marketed through its own live broadcast platform (Cheng and Yue, 2022).

2 Live broadcast platform cooperation mode: Brand cooperation and online live broadcast platform, directly on the platform to carry out live streaming activities. This model can help brands attract more viewers and customers, increase brand exposure and sales channels (Wang, 2022).

3 KOL mode: Brands work with their companies to sell their products by paying successful social media individuals or influencers. This model is suitable for small brands or the early stages of brand awareness, and live content can be monetised through sales by celebrities or influencers.

2.2 Online marketing characteristics of live streaming

2.2.1 Interact in real-time

The biggest feature of live streaming online marketing is instant interaction. In the traditional sales model, users search for keywords or tags according to their preferences and choose whether to watch them, but if the user's participation is not high, enterprises cannot intuitively understand the real reaction of consumers; It is also difficult to adjust the speed and passivity of information according to user requirements. The live streaming marketing model can effectively solve these problems, shorten the distance between users, give users the option to watch live broadcasts, and put forward their own opinions, thereby improving marketing effectiveness.

2.2.2 Spread widely

With the development of the live broadcast industry, live streaming breaks the restrictions of traditional media in interaction and production, and through live broadcasting, platform users can see the goods they care about at any time and interact with the live broadcast room. You can also invite your friends to watch the live broadcast through sharing behaviour, which has a wide spread. And through the popularity of the live broadcast room, some users who are interested in products can pay attention to new brands and products, increase the exposure of the brand through the live broadcast room, effectively promote the second marketing, and improve the communication efficiency. At the same time, through live streaming, sellers can rely on the online platform to sell to consumers nationwide, breaking through geographical and time restrictions, reducing marketing costs and inventory risks, and improving sales efficiency and economic benefits (Yu et al., 2022).

2.2.3 Precision marketing

At this stage, the live broadcast rooms that carry out live streaming goods are generally divided according to categories. For example, there are beauty, clothing, food, daily necessities, school supplies books, etc. users can search according to the content they are interested in, and choose the live broadcast room that meets their purchase goals to watch. The live broadcast room that carries out online marketing live streaming will also adopt corresponding promotion strategies according to the positioning and needs of the live broadcast crowd, and carry out targeted sales and services (Chen et al., 2022).

2.2.4 Passionate consumption

At this stage, one of the reasons why the performance of online marketing is generally higher than that of physical store marketing is that the discount of online marketing is large. Various e-commerce platforms regularly setup shopping promotions such as 'shopping festivals' to reduce the price of some products, enhance the shopping atmosphere, and promote consumers' consumption. In the live broadcast goods, many shopping activities are also arranged, and some large-value shopping coupons and coupons are issued, so that users can not only see the goods they want in the live broadcast room, but also purchase them at lower prices than usual (Shi, 2022). Since there will be anchors to display and use products in live streaming, it is easy for users to

have a desire to buy and produce passionate consumption. In addition, regular lotteries, red envelopes and other activities will be setup to attract a large number of users to flock to the live broadcast room to watch live broadcast goods, create a hot shopping atmosphere, stimulate consumers' desire to consume passionately, and increase sales performance (Cheng et al., 2022).

3 Design of comprehensive evaluation method for live streaming business model

3.1 Assessment indicators are determined based on the hierarchical methodology

In order to effectively analyse the current business model status of live streaming sales and promote the economic development of live streaming sales network business models, this article establishes a comprehensive evaluation system for live streaming sales business models based on the analytic hierarchy process. The system is mainly divided into target layer, criterion layer and indicator layer (Shen et al., 2021). The comprehensive evaluation results of the live streaming business model are set as the target layer to determine the operation effect of the live streaming business model; The criterion layer is the part that quantifies and summarises economic effectiveness, marketing effect, market competition, and consumer impact; the indicator layer is composed of indicators that can be directly measured (Lin and Fan, 2021), which is the most intuitive part of the comprehensive evaluation process of live streaming business model.

The accuracy and effectiveness of the comprehensive evaluation results of the live streaming business model directly depend on the determination of evaluation indicators, which is an important guarantee for obtaining fair and reasonable evaluation results (Yang, 2019). The evaluation index not only considers the particularity of online marketing, but also comprehensively considers the characteristics of the live streaming business model. In order to more comprehensively and accurately reflect the operating effect of the live streaming business model, when selecting indicators, it is necessary to take the background of live streaming as the main reference target to ensure that the selected indicators are representative and operable for better evaluation. Therefore, based on the indicators of the benchmark layer, detailed screening was carried out from them, and 20 evaluation indicators of the indicator layer were finally determined.

- Economic benefits: Live streaming mainly relies on online platforms for promotion and sales, and requires investment of certain resources, such as manpower, material resources, and funds, for promotion and sales activities. Therefore, in the live streaming sales business model, network marketing revenue, marketing costs, cost-effectiveness, marketing investment return rate, and product turnover are selected as secondary indicators to measure economic effectiveness.
- Marketing effect: The marketing effect of the business model of live broadcast with goods can be intuitively reflected by the number of audiences, attractiveness, purchase intention, audience stickiness and retention ability of live broadcast with goods. Therefore, live broadcast room traffic, conversion rate, click-through rate,

visit duration and activity viewing are selected as the secondary indicators to measure the marketing effect.

- Market competition: The level of market competition in the live streaming sales business model is an important indicator for evaluating the comprehensive ability of the model. Only by occupying an important position in the marketing market can the success of the live streaming sales model be reflected. Therefore, online brand influence, search engine ranking, market share, brand influence rate, and user return rate are selected as secondary indicators to measure the level of market competition.
- Consumer impact: The impact of the live streaming sales business model on consumers determines whether the model can develop in the long run. Therefore, we have chosen to increase customers, social media interaction, user retention rate, interaction rate, and user feedback as secondary indicators to measure consumer impact.

Table 1 lists the indicator layer evaluation indicators.

Table 1 Indicator layer evaluation indicators

Guidelines layer	*Metrics layer*	*Definition*
Economic effectiveness (T1)	Network marketing revenue (E1)	Revenue growth from the company's website and other marketing channels.
	Marketing costs (E2)	Plans, budgets, costs, and comparison with expected data for monthly or quarterly webcasts.
	Cost-effective (E3)	The ratio between inputs and outputs to determine the best network marketing method to use.
	Marketing ROI (E4)	The rate of return realised in network marketing.
	Product volume (E5)	The actual number of products sold via webcast.
Marketing effectiveness (T2)	Live room traffic (E6)	The number of views obtained through live room search entries or web platform link jumps.
	Conversion rate (E7)	Convert the number of people who watch the site into a percentage of users who buy it.
	Hits (E8)	How many people clicked on a company's ad or link on the web.
	Visit duration (E9)	The length of time the user stays in the live room.
	Event view rate (E10)	The more people who watched the webcast, the greater the impact of the event.
Market competition (T3)	Online brand presence (E11)	Increase brand awareness of the company's products and services through online marketing activities.
	Search engine ranking (E12)	The ranking of the company's website on search engines.
	Presence in the marketing field (E13)	The dominant share of a business in a particular marketing.
	Brand influence (E14)	The extent to which the company's brand awareness is enhanced through live streaming activities, including increasing user awareness and trust in the brand.
	User return rate (E15)	How often and at intervals when users return to the site.

Table 1 Indicator layer evaluation indicators (continued)

Guidelines layer	*Metrics layer*	*Definition*
Consumer impact (T4)	Increase customers (E16)	Increase your company's leads through web marketing campaigns.
	Social media interactions (E17)	Include the number of social media interactions such as comments, shares, likes, and retweets.
	User retention (E18)	The number of users returning after a certain period of time indicates how satisfied users are with the online live streaming goods and their willingness to pay attention and purchase for a long time.
	Engagement rate (E19)	The number of interactions between users and hosts, including likes, comments, shares and other interactive methods.
	User feedback (E20)	User evaluation and feedback on online live streaming activities, including quality evaluation of products, services, anchors and the entire event.

3.2 Determine the metric weights based on the entropy method

Entropy is a measure of uncertainty, which can also be understood as the average measure of information. When using entropy method for decision-making, it is hoped to obtain the result with minimal uncertainty. Therefore, when making decisions, it is necessary to evaluate the uncertainty of each element by calculating its entropy value. The smaller the entropy value, the lower the uncertainty of the element and the higher its value. Therefore, the entropy method can be used in chromatographic analysis to determine the weight values of various evaluation indicators, which can obtain more objective and accurate evaluation results.

Based on the evaluation indicators identified above. If there are m live streaming marketing plans at this stage and n evaluation indicators, then the attribute values of the n evaluation indicators in the m live streaming marketing plan can be represented by x_{ij}, so it can constitute an original matrix X, which is constructed as follows:

$$X = \begin{bmatrix} x_{11}, x_{12}, \ldots, x_{1n} \\ x_{21}, x_{22}, \ldots, x_{2n} \\ \cdots \\ x_{m1}, x_{m2}, \ldots, x_{mn} \end{bmatrix} \tag{1}$$

In order to avoid being affected by the magnitude and dimension of different evaluation indicators, it is necessary to normalise the evaluation indicators to obtain a normalised matrix Y composed of normalised indicators. This is shown in the following equation.

$$Y = \begin{bmatrix} y_{11}, y_{12}, \ldots, y_{1n} \\ y_{21}, y_{22}, \ldots, y_{2n} \\ \cdots \\ y_{m1}, y_{m2}, \ldots, y_{mn} \end{bmatrix} \tag{2}$$

Since live streaming is an interactive online sales model for marketing purposes, the evaluation indicators in the index matrix include benefit indicators and cost indicators Dx_{ij}, and the formula (3) is used to normalise and obtain the standard indicator X_{ij}:

$$X_{ij} = \begin{cases} Cx_{ij} = \dfrac{x_{ij} - x_{\min}}{x_{\max} - x_{\min}} \\ Dx_{ij} = 1 - \dfrac{x_{ij} - x_{\min}}{x_{\max} - x_{\min}} \end{cases} \tag{3}$$

In the formula, Cx_{ij} represents the normalised benefit-type index; Dx_{ij} represents the normalised cost-based index; $x_{\max}$ and $x_{\min}$ represent the maximum and minimum values of the indicator, respectively. Combine the result of formula (3) to obtain the final normalised matrix:

$$Y = \frac{Cx_{ij} \times Dx_{ij}}{X_{ij}\sqrt{\sum_{i=1}^{n} x_{ij}^2}} \tag{4}$$

According to the obtained normalised matrix Y and standard indicator X_{ij}, the information entropy value K_i of each indicator can be calculated by calculating the proportion E_{ij} of the i evaluation index of the j marketing plan, and the specific calculation formula is shown in equations (5) and (6):

$$E_{ij} = \frac{X_{ij}(Y)}{\sum_{j=1}^{n} X_{ij}} \tag{5}$$

$$K_i = -k\sum_{j=1}^{n}\left(E_{ij}\ln E_{ij}\right), k = \frac{1}{\ln n} \tag{6}$$

When $E_{ij} = 0$, $E_{ij}\ln E_{ij} = 0$.

Information entropy can reflect the uncertainty and randomness between different evaluation indicators, but because there are many evaluation indicators, there is always a certain degree of redundancy in the process of entropy calculation. Redundancy values can be used to measure the contribution value of each evaluation metric task in different marketing plans. If the redundancy value of an evaluation indicator is too small, it means that the connection between the indicator and the marketing plan has a small contribution value to the indicator task, and if the contribution value is too large, the indicator can be prioritised and processed. Therefore, the redundant value d_j of the information entropy needs to be calculated, as shown in equation (7):

$$d_j = 1 - K_i \tag{7}$$

After obtaining the redundant values, you can solve for the weights of each evaluation metric, as shown in Equation (8):

$$\omega_j^n = \frac{d_j}{\sum_{j=1}^{n} d_j} \tag{8}$$

In the formula, ω_j^n represents the weight of n evaluation metrics.

Through the formula calculation, the weight results of the 20 evaluation indicators of the indicator layer can be obtained, as shown in Table 2.

Table 2 Weights of evaluation indicators

Guidelines layer	*Guidelines layer weight*	*Metrics layer*	*Metrics layer weight*
Economic effectiveness (T1)	1.26	Network marketing revenue (E1)	1.06
		Marketing costs (E2)	1.45
		Cost-effective (E3)	0.88
		Marketing ROI (E4)	1.25
		Product volume (E5)	1.18
Marketing effectiveness (T2)	1.03	Live room traffic (E6)	0.92
		Conversion rate (E7)	1.24
		Hits (E8)	0.85
		Visit duration (E9)	0.62
		Event view rate (E10)	0.65
Market competition (T3)	0.96	Online brand presence (E11)	1.01
		Search engine ranking (E12)	1.15
		Presence in the marketing field (E13)	0.65
		Brand influence (E14)	0.60
		User return rate (E15)	0.52
Consumer impact (T4)	0.82	Increase customers (E16)	0.59
		Social media interactions (E17)	0.66
		User retention (E18)	0.62
		Engagement rate (E19)	0.55
		User feedback (E20)	0.30

3.3 Evaluation results based on the composite evaluation index

After obtaining the weight results of the evaluation indicators, the comprehensive evaluation method was used to comprehensively evaluate the 20 indicators.

First, determine the relevance of the evaluation indicators. Let R_i be the correlation between X_i and X_0, $R_i = (i = 1, 2, \ldots, m)$. Set the correlation coefficient row vector as Q, and combine the weight ω_j^n of each evaluation index to calculate the correlation degree between different marketing plans:

$$R_i = Q \times \omega_j^n = [\sigma_1, \sigma_2, \ldots, \sigma_n] \times \begin{bmatrix} w_1 \\ w_2 \\ \cdots \\ w_n \end{bmatrix} \tag{9}$$

R_i can represent the correlation between the evaluation index X_i and X_0, so the index can be comprehensively evaluated through the correlation degree between each indicator and different marketing plans.

Combined with the actual operating environment of the live broadcast room, the live streaming business model is scored according to the content of the evaluation indicators. According to the score, the corresponding level is matched, so as to obtain the comprehensive evaluation results of the live streaming business model in the online marketing environment. The comprehensive evaluation method was used to comprehensively evaluate 20 indicators and establish a comprehensive evaluation index, as shown in equation (10):

$$F = \sum_{i=1}^{n} \omega_j^n(r) \times R_i \tag{10}$$

In the formula, F stands for composite evaluation index; r indicates the corresponding score of each evaluation index after normalisation.

Set the evaluation level of the live streaming business model, and match the corresponding evaluation level results according to the obtained comprehensive evaluation index. Combined with 20 evaluation indicators, set 5 scoring scales with a total score of 10 points, with the fluctuation of every 2 points as the division standard, the 5 scoring levels are: 0~2, >2~4, >4~6, >6~8, >8~10, corresponding to poor, medium, good, good, excellent.

4 Experimental results and analysis

4.1 Experiment setup

In order to verify the effectiveness of the comprehensive evaluation method of live streaming business model proposed in this paper in practical application, 10 live broadcast platforms, T, D, K, J, P, X, W, Y, S and M that rank high in the current live streaming platform are selected as the test live broadcast platforms. In order to ensure the fairness of the evaluation results, among the popular rankings of these 10 live broadcast platforms, the 10th ranked live broadcast room was selected as the test object, and these live broadcast rooms were numbered T1, D1, K1, J1, P1, X1, W1, Y1, S1 and M1 live broadcast rooms, and the live streaming business model of the 10 live broadcast rooms was comprehensively evaluated. Collect the historical operation data of each live broadcast room from 20 October~29 October 2022 as a dataset and import it into the database. The operating system of this experiment is a Windows 10 system with 32 GB of memory, equipped with a 99900 KCPU @ 3.60 GHz processor, equipped with 8 bit 74HC165D model data registers, and running simulation software MATLAB R2019a. A total of 56.3 GB of historical operation data in the existing live broadcast room can be retained as experimental data samples after data cleaning, and a total of 50.0 GB of operation data can be retained after removing duplicate and redundant operation data. Through the Python random sampling algorithm, 80% of the data is used as the training dataset and 20% of the dataset is used as the test dataset. The training dataset is 40.0 G and the test dataset is 10 G. The error of the test results and the actual results is less than 20%, which can meet the needs of experimental testing.

4.2 Comprehensive score result analysis

The comprehensive evaluation method was used to score and count the 20 indicators evaluated by the live streaming business model, and the comprehensive evaluation scores of each live broadcast room were obtained, as shown in Table 3.

Table 3 Comprehensive assessment scores

Guidelines layer	*Metrics layer*	*Assessment area*									
		T1	*D1*	*K1*	*J1*	*P1*	*X1*	*W1*	*Y1*	*S1*	*M1*
T1	E1	8.56	8.32	7.59	7.59	7.23	7.26	7.32	7.11	7.25	7.35
	E2	9.23	9.11	8.56	8.35	8.23	8.75	8.11	7.95	7.65	7.88
	E3	8.63	8.65	8.32	8.23	8.23	8.20	8.21	8.20	8.19	8.18
	E4	9.21	9.02	9.00	8.95	8.88	8.85	8.86	8.84	8.85	8.86
	E5	9.27	9.35	9.00	9.20	8.95	8.85	8.75	8.65	8.65	8.44
T4	E6	8.65	8.56	8.11	8.05	7.95	7.99	7.96	7.93	7.90	7.82
	E7	8.32	9.01	8.96	8.88	8.85	8.83	8.81	8.75	8.62	8.66
	E8	8.01	8.52	8.23	7.95	7.93	7.85	7.77	7.76	7.55	7.45
	E9	8.22	8.02	7.95	8.00	7.85	7.65	7.35	7.33	7.42	7.30
	E10	7.95	8.06	7.93	7.82	7.85	7.80	7.74	7.72	7.65	7.60
T3	E11	8.52	7.85	7.85	7.25	7.45	7.65	7.30	7.11	7.03	7.00
	E12	8.02	7.65	7.66	7.52	7.51	7.46	7.33	7.38	7.30	7.25
	E13	8.33	7.44	7.34	7.05	7.00	6.95	7.00	6.85	6.72	6.66
	E14	7.75	8.11	8.02	7.73	7.62	7.52	7.50	7.41	7.42	7.40
	E15	7.65	7.68	7.65	7.36	7.35	7.20	7.15	7.10	7.00	6.95
T4	E16	7.95	7.85	7.23	7.15	7.05	6.95	6.92	6.94	6.85	6.81
	E17	8.02	8.10	7.56	7.51	7.43	7.40	7.35	7.54	7.44	7.35
	E18	8.26	7.65	7.22	6.95	6.85	6.75	6.55	6.45	6.45	6.45
	E19	7.54	7.24	7.11	7.00	6.95	6.88	6.80	6.84	6.80	6.75
	E20	8.62	8.23	7.95	7.82	7.64	7.67	7.52	7.64	7.58	7.36
Average		8.34	8.22	7.96	7.82	7.74	7.72	7.62	7.58	7.52	7.48

As can be seen from Table 3, in the live broadcast rooms of 10 different platforms, T1, D1, K1, J1, P1, X1, W1, Y1, S1, and M1 are sorted from high to low. The evaluation grade of the live streaming business model of T1 and D1 live broadcast room was excellent, and the evaluation grade of the other 8 live streaming business models was good.

Among them, in the T1 live broadcast room delivery mode, the indicators of network marketing revenue (E1), marketing cost (E2), marketing ROI (E4), live room traffic (E6), visit duration (E9), online brand presence (E11), search engine ranking (E12), Presence in the marketing field (E13), increase customers (E16), user retention (E18), engagement rate (E19) and user feedback (E20) were scored. It shows that the live broadcast room has good performance in the above indicators, so the total score can reach 8.34 points, and the evaluation grade is excellent.

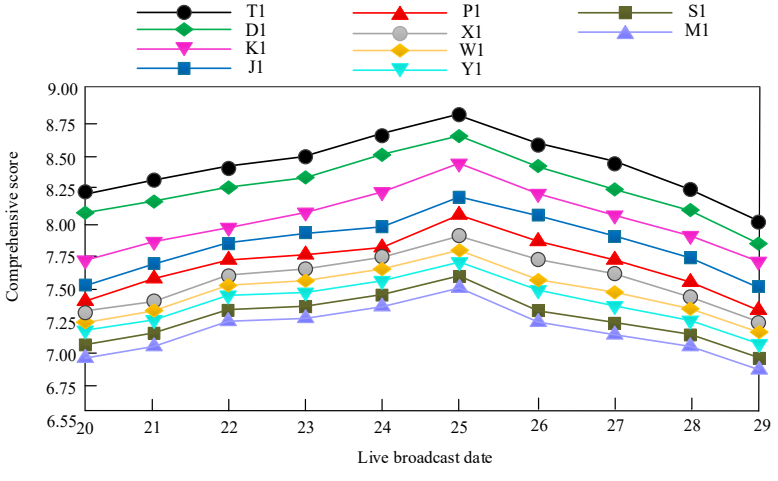
In the delivery mode of D1 live broadcast room, the indicators of cost-effective (E3), product volume (E5), conversion rate (E7), hits (E8), event view rate (E10), brand influence (E14), user return rate (E15) and social media interaction (E17) were all scored, indicating that the live broadcast room has better performance in the above indicators, so the total score can reach 8.22 points, which is close to the score of the T1 live broadcast mode, and the evaluation grade is also excellent.

In addition, the indicators that can score more than 9 points are marketing cost (E2), marketing ROI (E4), product volume (E5) and conversion rate (E7), indicating that in the live streaming business model, these four indicators have the highest completion rate, to a certain extent, it also shows that the impact of these four indicators on the live streaming business model is higher than other indicators. This is consistent with the weight results of evaluation indicators obtained in this article, indicating that the evaluation method proposed in this article can accurately analyse the importance of evaluation indicators and help improve the accuracy of evaluation results.

4.3 Changes in composite score levels

In order to verify the marketing effect of different live streaming business models, the comprehensive scores of each live broadcast room from 20 October~29 October 2022 were counted, and a schematic chart of the change of score level was drawn, as shown in Figure 1.

Figure 1 Schematic diagram of the change of comprehensive score level (see online version for colours)



As can be seen from Figure 1, the comprehensive score change trend of each live streaming business model is basically the same, indicating that on the whole, the operation of the live streaming business model is almost in the same range. Among them, the score of the 25th is the peak, the comprehensive score of each live broadcast room live streaming business model on the 25th is higher than that of other dates, from the 20th to the 25th, the score of each live broadcast room live streaming business model is in an upward trend, after 25 days, the score of each live broadcast room live streaming business model began to show a downward trend, but the average overall comprehensive score is

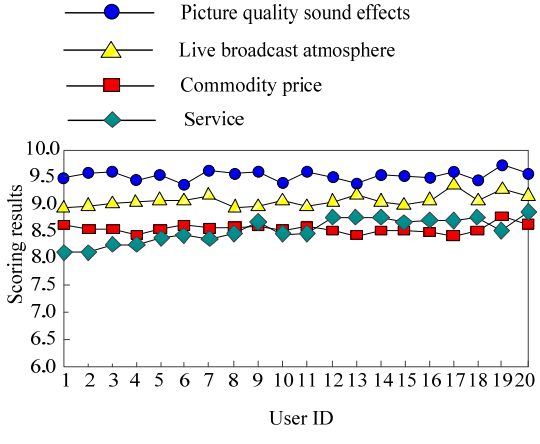
not much different from the average score of Table 3. After analysis, it was learned that 25 October is the date when the e-commerce platform holds a shopping festival to start snapping up and paying a deposit, and the promotional activities of the e-commerce platform can attract more users to participate in shopping, which has played a positive role in the live streaming model, so on the 25th, the economic effectiveness, marketing effect, market competition, and consumer impact indicators of each live broadcast room are at a high level, making the purchase behaviour more concentrated, and having a certain impact on the user flow and sales of the live streaming mode.

It can be explained that the live streaming business model in the online marketing environment is in a relatively active state at this stage, and consumers participating in live streaming will be affected by the activities of various e-commerce platforms, which will promote certain positive changes in the economic effectiveness, marketing effect, market competition and consumer impact indicators of each live broadcast room. The results obtained by the evaluation method proposed in this article are consistent with the actual state of the live streaming sales business model. Multiple secondary indicators designed can better measure economic effectiveness, marketing effectiveness, market competition, and consumer impact, which can reflect the good practical application performance of the proposed method in this article.

4.4 User recognition

In order to verify the accuracy of the comprehensive evaluation results of the live streaming business model in this paper, taking the user feedback index in the consumer impact index as an example, 200 platform users in a live broadcast room were randomly selected to enter the electronic questionnaire survey on the recognition of the live streaming activity on the 25th, and the survey content included the picture quality and sound effects, live broadcast atmosphere, customer service and commodity price in the live broadcast room, and scored according to the degree of satisfaction, and the corresponding score of dissatisfaction ~ very satisfied was 1~10 points. The scoring results of 20 users were randomly selected for statistics, and the user recognition curve was drawn, as shown in Figure 2.

Figure 2 User recognition curve (see online version for colours)



As can be seen from Figure 2, the recognition rating of 20 users for the live streaming event is between 8.0~9.7 points. Among them, the user's score for picture quality and sound effect is between 9.3~9.7 points, the score for live broadcast atmosphere is between 8.8~9.3 points, the score for customer service is between 8.0~8.7 points, and the score for commodity price is between 8.2~8.6 points. It can be shown that the user's recognition of the live streaming mode is higher than 8 points, which is on the high side, and the recognition of 20 users for picture quality and sound effects, live broadcast atmosphere and commodity price is basically at the same level, and only the score of customer service fluctuates greatly, indicating that consumers at this stage have a high degree of recognition of the live streaming model, and the live streaming mode can have a certain impact on consumers' consumption behaviour, which is consistent with the comprehensive evaluation results of the live streaming business model in this paper. It proves that the evaluation method proposed in this paper has a certain accuracy.

5 Conclusions

As a form of online marketing, live streaming has gradually emerged in the domestic market in recent years and has become a representative of innovative business models and new consumption methods. In the online marketing environment, the importance of studying the business model of live streaming is becoming more and more prominent. Therefore, based on the hierarchical method, entropy value method and comprehensive evaluation index, this paper designs a comprehensive evaluation method for the business model of live streaming goods.

1 Based on the analytic hierarchy method, economic effectiveness, marketing effect, market competition, and consumer impact are taken as the indicators of the criterion layer, and 20 evaluation indicators of the index layer are determined after screening; Based on the entropy value method, the index weight is calculated, and the business model of live streaming is comprehensively evaluated by combining the comprehensive evaluation index, and the evaluation results are matched with the evaluation level to obtain the final evaluation results.

2 An evaluation of the live streaming models of ten different live streaming platforms found that the completion rate of the four indicators, namely marketing cost, marketing investment return rate, product turnover, and conversion rate, was the highest. This indicates that the live streaming sales business model will be affected by these four indicators in the online marketing environment. For the live streaming sales business model, economic and marketing effectiveness are very important considerations.

3 At present, the overall score trend of the live streaming sales business model in various live streaming rooms is basically consistent, and consumers participating in live streaming sales will be affected by the activities of various e-commerce platforms, promoting the economic effectiveness, marketing effectiveness, market competition, and consumer impact indicators of each live streaming room to be improved to a certain extent, resulting in positive changes. In addition, the users' recognition of the live video delivery mode is higher than 8 points, which indicates that consumers at this stage have a high recognition of the live video delivery mode.

The live video delivery mode can have a certain impact on consumers' Consumer behaviour, which is consistent with the comprehensive evaluation results of the direct video delivery business model in this paper, proving that the evaluation method proposed in this paper has a certain accuracy.

4 Through the research in this article, a detailed analysis and effective evaluation of the live streaming sales business model can be conducted, which is conducive to the development of the live streaming sales network business model. Being able to better grasp the new changes and trends in the online marketing environment, assist the live streaming sales model in formulating scientific marketing strategies and management plans, improve product quality and service levels, enhance user experience and satisfaction, and provide better marketing strategies and practical experience for e-commerce platforms in online sales.

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